Plant Pathology Circular No. 207
December 1979

Fla. Dept. Agric. & Consumer Services
Division of Plant Industry

RHIZOCTONIA BLIGHT OF LONGLEAF PINE SEEDLINGS

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The fungus, Rhizoctonia solani Kuhn, causes a variety of disease problems on a wide range of plant species throughout the world (15). Foresters have long recognized R. solani as a primary cause of seed (pre-emergence) and seedling (post-emergence) "damping-off" in nursery seedbeds of both conifers and hardwoods (3).

In 1941 Davis (5) described a disease of longleaf pine (Pinus palustris Mill.) occasionally referred to as "sand splash" or "sand-silt drift" which he attributed to infection by R. solani in forest nurseries in Mississippi, North Carolina, and South Carolina. In recent years this problem has been confirmed in at least four commercial forest tree nurseries in Florida (Fla. Dept. Agric. & Consumer Serv., Div. of Plant Ind., unpublished). To date, damage resulting from this disease has not been regarded as serious. However, as interest in the silviculture of longleaf pine increases and demand for nursery stock rises, losses could become economically important.

DISEASE DEVELOPMENT & SYMPTOMS: Longleaf pine remains in a "grass stage" for approximately 3 to 6 years following seed germination (8). During this period the terminal bud with its needles remains at the soil surface, and seedlings resemble clumps of grass while growth is largely restricted to the root system (7, 8). As a result, susceptible tissues of longleaf pine are vulnerable for extended periods of time to infection by R. solani which commonly exhibits a soil-line habit of its own (12, 15).

As infection proceeds, the bases of affected needles become chlorotic, discolored, and/or water-soaked and eventually rot. Rot is also common on stem and bud tissues at or near the soil surface as well as on roots in the upper layers of soil. Infection can also occur on distal needle parts as a result of needles touching the soil surface (5). Diseased seedlings become completely discolored and die, and affected seedbeds are characterized by circular to irregular patches of dead and dying seedlings (Fig. 1).

Fig. 1. Rhizoctonia blight of longleaf pine seedlings in a forest tree nursery: A) Infection center; B) Infected seedlings.

Presumably, nursery seedbeds are initially colonized by 1} residual populations of R. solani in seedbed soils either in the form of persistent sclerotia or saprophytically surviving mycelia; 2) aerially disseminated basidiospores of Thanatephorus cucumeris (Frank) Donk (the sexual stage of the pathogen); and/or 3) introduction of R. solani on unclean seed (15). (Regarding this last mode, it is perhaps significant that Davis (5) observed more disease on seedlings from longleaf pine seed stored for 2 or more years than on seedlings from current year seed.) Disease spread within seedbeds is affected by mycelial growth from seedling to seedling via direct contact or through soil and/or the physical movement of infested soil via machinery, irrigation, etc.

Isolates are variable, but in general, activity and pathogenesis of R. solani appear to be enhanced by warm temperatures, neutral to somewhat alkaline soils, and high relative humidity (5, 15, 17). Davis (5) observed that disease was worse on longleaf pine seedlings in sandy soils because sand, washed by rain and irrigation, accumulated at the base of seedlings, thus creating microenvironments of reduced aeration and increased relative humidity. His observations are consistent with observations in Florida.

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CONTROL: As a damping-off pathogen, R. solani has been effectively controlled through the use of numerous soil and seed treatments (2, 4, 9, 10, 12, 15, 21). The efficacy of such treatments may vary considerably depending upon isolate tolerance, environmental conditions, etc. (11, 16, 18, 19, 20), and, as pointed out by Davis (5), such treatments may be ineffective in view of the extended period of exposure/susceptibility due to the grass stage habit of longleaf pine.

Papavizas et al. (13) found that activity of R. solani was reduced by the incorporation of certain organic residues into the soil in conjunction with varying levels of ammonium nitrate. In a somewhat similar vein, Davis (5) reported less disease on longleaf pine when seed was covered with ca. 1/4 inch (6 mm) of sawdust as opposed to soil. While control methodologies of this type could prove beneficial, inherent limitations such as availability of resources as well as anticipated variabilities in success may preclude their widespread use in forest nurseries.

Several newer fungicide materials show promise for controlling R. solani (1, 14, 15) and one of these (benomyl) has demonstrated usefulness as a soil drench on longleaf pine in Florida forest tree nurseries (Seymour and Miller—personal communication). However, caution is advised relative to repeated and/or unnecessary use of fungicides as R. solani is capable of developing tolerance to a variety of materials under such conditions (6, 19).

An integrated approach employing: 1) effective seedbed fumigation; 2) good cultural and sanitation practices including the use of clean, quality seed; and 3) judicious use of proven fungicide materials should provide adequate control of R. solani on longleaf pine under most forest nursery conditions.

DETECTION AND SURVEY: Look for circular to irregular patches of dead and dying seedlings. Patches will vary in size, and individual seedlings will be discolored in varying degrees, particularly near the bases of needles. Soil heaped up against the terminal bud and needle bases may also be a useful indicator for blight. Laboratory diagnosis is essential for confirmation.

LITERATURE CITED:

1. Alfieri, S. A., Jr., C. P. Seymour, and J. C. Denmark. 1972. Aerial blight of Carissa grandiflora caused by Rhizoctonia solani. Plant Dis. Reptr. 56:511-514.
2. Birchfield, W., and G. F. Weber. 1951. Control of Rhizoctonia damping-off of Pinus caribaea seedlings. Phytopathology 41:4 (Abstr.).
3. Boyce, J. S. 1961. Forest pathology. McGraw-Hill Book Co., New York. 572p.
4. Cram, W. H., and 0. Vaartaja. 1957. Rate and timing of fungicidal soil treatments. Phytopathology 47:169-173.
5. Davis, W. C. 1941. Damping-off of longleaf pine. Phytopathology 31:1011-1016.
6. Elsaid, H. M., and J. B. Sinclair. 1964. Adapted tolerance to organic fungicides by isolates of Rhizoctonia solani from seedling cotton. Phytopathology 54:518-522.
7. Fowells, H. A. 1965. Silvics of forest trees of the United States. U.S.D.A. For. Serv. Agric. Hndbk. No. 271 762p.
8. Harlow, W. M., and E. S. Harrar. 1958. Textbook of dendrology. McGraw-Hill Book Co., New York. 561p.
9. Hocking, D., and A. A. Jaffer. 1969. Damping-off in pine nurseries: fungicidal control by seed pelleting. Commonwealth For. Rev. 48:355-363.
10. Jacks, H. 1956. Glasshouse tests for control of damping-off of Pinus radiata seed. N. Z. J. Sci. and Tech. (Sect. A) 37:427-431.
11. Kennedy, B. W., and L. A. Brinkerhoff. 1959. Comparison of four soil fungicides in greenhouse for the control of seedling disease of cotton. Plant Dis. Reptr. 43:90-97.
12. Ko, W. H., J. E. Hunter, and R. K. Kunimoto. 1973. Rhizoctonia disease of Queensland maple seedlings. Plant Dis. Reptr. 57:907.
13. Papvizas, G. C., C. B. Davey, and R. S. Woodard. 1962. Comparative effectiveness of some organic amendments and fungicides in reducing activity and survival of Rhizoctonia solani in soil. Can. J. Microbiol. 8:915-922.
14. _____, J. A. Lewis, and N. R. O'Neill. 1979. BAS 389, a new fungicide for control of Rhizoctonia solani in cotton. Plant Dis. Reptr. 63:569-573.
15. Parameter, J. R., Jr. (ed.). 1970. Rhizoctonia solani, biology and pathology. Univ. Calif. Press, Berkeley. 255p.
16. Ranny, C. D., and L. S. Bird. 1956. Greenhouse evaluation of in-the-furrow fungicides at two temperatures as a control measure for cotton seedling necrosis . Plant Dis . Reptr. 40:1032-1039 .
17. Roth, L. F., and A. J. Riker. 1943. Influence of temperature, moisture, and soil reaction on the damping-off of red pine seedlings by Pythium and Rhizoctonia. J. Agric. Res. 67:273-293.
18. Rushdi, M., and W. F. Jeffers. 1956. Effect of some soil factors on efficiency of fungicides in controlling Rhizoctonia solani. Phytopathology 46:88-90.
19. Shatla, M. N., and J. B. Sinclair. 1963. Tolerance to pentachloronitrobenzene among cotton isolates of Rhizoctonia solani. Phytopathology 53:1407-1411.
20. Sinclair, J. B. 1960. Reaction of Rhizoctonia solani isolates to certain chemicals. Plant Dis. Reptr. 44:474-477.
21. Vaartaja, 0., and M. Bumbieris. 1965. Control of conifer damping-off in south Australia. Plant Dis. Reptr. 49:504-506.